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Survey Paper from Directed Readings: Interactive Narrative (IN)

Introduction

Interactivity:

a) Reciprocally active; acting upon or influencing each other; allowing a two way flow of information between a device and a user, responding to the users input.

Narrative:

a) A narrative has an initial state, a change in that state, and insight brought about by that change. You might call this process the "events" of a narrative
b) A narrative is not merely a series of events, but a personification of events through a medium such as language. This component of the definition references he representational aspect of narrative.
c) A representational aspect of narrative is constituted by patterning and repetition. This is true for every level of narrative, weather it is the material form of the narrative itself or its conceptual thematic. (Zimmerman 2004)

Interactive Narrative Technologies is still emerging as a field of research. It is unique in that it inherent s aspects of both the humanities and computer sciences in understanding and implementation. This paper will discuss the relevant theoretical foundations of narrative and the extents it has been able to merge with computational processes in computer sciences. Recent achievements incorporating perspectives of emotion, behavior, and believability in complex character, drama management, and visual presentation systems reveal both an optimistic outlook as well as highlight the future challenges ahead.

Select authors and their contributions are noted and evaluated in relation to the topic. This paper is broken into three sections. The first section introduces narrative and interactive fiction from a literary perspective across several genres. The second section addresses seminal works in computer sciences that set a foundation for systems to generate meaningful text-based stories. The third section presents developed and integrated systems and also introduces visual presentation and an interaction model that address many aspects of the works expressed in the first two sections. Furthermore as developed systems are presented, interactive narrative as a genre begins to simultaneously take form and reveal challenges ahead.

1. Foundations in Narrative and Interactive Fiction

The first questions are broad ones, what precisely a story is and what aspects can be made interactive. Of course this is highly dependent upon expectations set between teller and listener. This section will discuss fundamentals in narrative such as plot, character, story arc, story types, the audience perspective, and stories in relation to new media forms such as film and hypertext. These authors introduce concepts which, in the following

sections computer scientists have encoded to a certain extent and are a relevant means of assessing current systems. At the end of this section, text based examples in interactive narrative will be examined.

1.1 Classical Foundations in Narrative

In Aristotle's Poetics lays the foundation that describes narrative through great theatrical tragedy. It is surprising to see how relevant such a wealth of work is on this topic today and no wonder why many theorists refer their ideas in relationship to his, as many key elements in interactive narrative are introduced. Furthermore his organization of narrative sets the stage for agreement and disagreement in the writers and programmers that have succeeded him… For Aristotle, tragedy is a mix of action *and* story that can be broken down into six parts which determine its quality: *plot, character, diction, thought, spectacle, and song*.

> "Tragedy, then, is an imitation of an action that is serious, complete, and of a certain magnitude; in language embellished with each kind of artistic ornament, the several kinds being found in separate parts of the play; in the form of action, not of narrative; through pity and fear effecting the proper purgation of these emotions." (Aristotle)

For Aristotle, it is the primacy of plot that is most important as it governs possible actions with direction.

> "…if you string together a set of speeches expressive of character, and well finished in point of diction and thought, you will not produce the essential tragic effect nearly so well as with a play which, however deficient in these respects, yet has a plot and artistically constructed incidents. " (Aristotle)

For Aristotle, the best kinds of tragic plot conform to the audience expectations. The plot should not shock without cause, must have a tragic quality that satisfies the moral sense, and the moral sense cannot be realized without merit. "We must not demand of tragedy any and every kind of pleasure, but only that which is proper to it". Though somewhat vague in definition, Aristotle outlines the following plot concepts: completeness, magnitude, unity, structure, and universality. Many aspects of his theories especially regarding plot is addressed in the proceeding sections.

Plot dictates actions which are conveyed through character, the second part of tragedy. "Thus tragedy is the imitation of an action, and of the agents mainly with a view to the action." (Aristotle). However, it is through the virtues of character that moral purpose is revealed. The ways by which characters communicate this purpose is through thoughts or intentions - that is, the extents to what is possible and pertinent for a given character in certain circumstances. Diction is the expression of purpose into words in verse and prose a command, a prayer, a statement, a threat, a question, an answer, and so forth.

For Aristotle, the audience spectacle and song is subservient to all and merely serves as an embellishment to the preceding parts. He goes on to say these types "spectacular effects depends more on the art of the stage machinist than on that of the poet." This notion in particular is often discussed in relation to interactive narrative because a user model that promotes agency, immersion, and transformation is often viewed in opposition to the Aristotelian model (Murray 1997). Furthermore, the spectacle and song components in the Aristotelian model

infer a presentational and stylistic model of delivery often viewed with the highest importance in terms of in interactive narrative (El-Nasr 2007).

In summary, Aristotle's theories of the poet as storyteller are still relevant today in many performance arts fields where the authorial contribution itself, is to be viewed as fixed. This however, is a reoccurring conflict for interactivity which will be discussed later in this paper, where the story incarnation or author rendition in fact change to some degree from a user standpoint. New questions surface when a model of encoding stories permits adaptation. For this level of understanding, there needs to be a better understanding of a story grammar.

1.2 Contemporary Narrative Structures and insight into Interactive Narrative

Before thinking about story adaptation or branching, the first question is how can we better understand stories such that subtle differences between them can be encoded beyond vague interpretations? There needs to be some form of grammar or rule to address this question. This is what V. Propp asked in 1928 in his scientific approach, a syntactic structural analysis of a text: empirical and inductive of Russian folk narrative. His result is a rigid classification scheme via functions whereby the folktales he evaluated must all logically fit in. The basic tenet of this work is the structural analysis of literary works from the Aarne-Thompson Index of folktale types. His reductionist approach was to strip a text of its social and cultural context such that it was not context centered.

> "…we shall make a comparison of tales according to their components. The result will be a morphology (i.e., a description of the tale according to its component parts and the relationship of these components to each other and to the whole" (Propp 1928)

Propp's method was that functions manifest through characters because they serve as stable, constant elements in a tale, independent of how and by whom they are fulfilled and that they constitute the fundamental components of a tale. Although this character-centric view is in opposition to Aristotle's, Propp's technique could have potentially offered insight into Aristotle's notions of plot-types such as reversal, recognition, and suffering. Lastly, the number of functions known to the fairy tale is limited and the sequence of functions is *always* identical. The following is a sample Propp function (number 6 of 31)

> The villain attempts to deceive his victim in order to take possession of him or her of his belongings (trickery)
> 1. The villain uses persuasion
> 2. The villain proceeds to act by the direct application of magical means
> 3. The villain employs another means of deception or coercion

Although functions should be viewed sequentially, the above function on its own seems inadequate to delineate specificity in meaning especially in plot. When appropriate, Propp fills the functions with addendums to be certain it is reflected in particular tales. For example in function 19:" The initial misfortune or lack is liquidated", has 11 such addendums.

What did we learn from Propp? There seems to be general problems with the translational (as in communication) aspect of abstraction. Firstly, he did not seem to take rigorous action to reverse engineer his own

approach and comment on the interesting questions it raises. Many computer scientists can thank him for this joy. For instance, can a symbolic tale represented by an identical usage of his functions end up having altogether very different stories contextually? Or for this matter, why could one resonate well and another not make any sense say for cultural or gender reasons? Furthermore, I am curious if any of the 100 tales Propp did encode were fortunate enough to be coincidentally 100% symbolic duplicates of each other already, or were the contextual differences wide enough to merit an addendum to a specific function? This conundrum in evaluation has been followed up by Peinado.

Second, since Propp predated interactive narrative, he certainly was not thinking of his work in a state of constant flux. All of the integrated systems discussed later are to some extent dynamically updating and assume a high contextual detail in this process. It is not clear how such as system could integrate into Propp's model for instance, the logic behind how these details are represented through the function.

In the follow-up to Propp's theories by Peinado in creativity Issues in plot generation, the problem of computational creativity is highlighted. Basically, Propp's model was encoded into a story generative model and the results were presented (in abstract plot structure form) to a panel of judges…

> "…the judges have no idea about the history of the system and the content of its case base, so they try to compare the generated plot with all the stories they have read, hear or seen during their lives. We found that this kind of evaluation is not a good idea because each judge has different narrative experiences and, of course, none of them knows all the stories in the world."(Gerv´as 2005)

Furthermore the authors decided *not* to embellish the language representation of the tale for the purposes of avoiding a "noise effect" when in fact Egris (mentioned soon) might argue that it is precisely the noise effect that makes all the difference in compelling stories. Finally the authors conclude that Prop function coherence is not necessarily the only *value* for a narrative.

The question again is centered upon strategies for encoding story generation from existing conventions. In addition to theatrical dramas or folktales, conventions in screenwriting for film or television is perhaps more familiar and popular as a storytelling approach. The next authors, Egris, Foss, and Boorstin all make several theoretical and practical observations about story creation qualities of this medium. Many of these views are in accordance with Aristotle's classical notions.

For Egris, the premise is critical when formulating a plan. "Every good play must have a well-formulated premise". Egris would agree with Aristotle's notion of plot as well "Good acting, excellent production, and clever dialogue may spell success sometimes, but they alone will never make a good play." This, premise is similar to the moral of the story – something Propp's functions could not capture. Furthermore, the same premise "seed" can be used with multiple stories although its manifestation will be unique to that story. Contrast this again to Propp's model where all tales share the same inherent structures except with different outcomes.

Take for example the moral fr*ugality leads to waste:*

- The first part of this premise suggests character -- a frugal character
- The second part, *"leads to,"* suggests conflict
- and the third part, *"waste,"* suggests the Conclusion/Resolution of the play

(Egris 1960)

Conflict is another aspect touched upon in his work. Egris identifies 4 types: static, jumping, slowly rising, and foreshadowing. In the example above, foreshadowing is the primary means of conflict. Static refers to no climax and results from indecisive characters or those who don't know what they want (which leads to boring stories). Jumping refers to a transformation from one extreme to another (such as sobriety to drunkenness) and slowly rising grows naturally without effort.

Furthermore Egris digs into the dimensionality of character to a depth Aristotle's Poetics didn't explore and may in fact be in contradiction to Propp's functions "No two scenes should ever be alike and no two characters should ever do something the same way"(Egris 1960) . The writers must describe the need to know their characters in depth to ensure that their characters' personalities come through in their actions. For Egris, every character is represented by these 3 dimensions:

- Physiology -mechanical, physical, and biochemical functions of living organisms
- Sociology – race, class (socio, education), gender, creed, interests, politics
- Psychology – ambitions, frustrations, temperaments, complexes, sex, abilities, qualities

Many of these dimensions will be revisited in the following sections when computational models address character emotion and behavior. The problem with Egris compassionate style is that validating proofs for his conventions are often assumed and not defined well. Not only does this lead researchers to seek alternative approaches in story generation, but also leads to a conundrum for interactive narrative itself. For Egris, story is sacred and expressively representative (and reflective) of the author. Compromising this control through interactivity storytelling would unleash resistance.

Bob Foss has made similar claims in filmmaking, narrative, and structural techniques. The problem of interactivity is highlighted again as explicit audience interaction is not a central tenet of filmmaking and in many cases it is seen as an opposing force to filmmaking as a whole. Take for example the following table by Foss where loss of control in screenwriting leads to incomprehensible results:

The Differences between Drama	**…and Real life**
Everything under control	Nothing under control
The writer/filmmaker determines the development of action according to rules and conditions imposed by him	the development of action is determined by an endless jumble of causes and conditions
Action is logical and necessary	Action is causal and irregular
Reality is known	Reality is unknown

Hence, there doesn't seem to be any room for interactivity from a filmmaking authorial view but Boorstin offers some insight into more passive ways an audience may participate with film:

- the *voyeuristic eye* - the curious observer and the feeling of joy resulting from discovery and learning
- the *vicarious* eye - when we feel what the actors feel through an understanding of characters' emotions and choices

- the *visceral* eye- the self experienced thrill expressed through character portrayal and the feeling of enjoyment as a result
  (Boorstin 1990)

For Egris, Foss, and Boorstin the emphasis is tailored towards screenwriters or filmmakers trying to make-it in the industry rather than underlining patterns for encoding story generation. The unfortunate consequence is that analysis tends to rely on the (box office) successes of other famous stories vs. empirical truths. Because film has become embedded in its own discourse theories, at some level there is an inherent clash of expectations when interactive narrative is introduced. Without getting too far into the Narratology and Ludology debate – one must not forget that interactivity is also bridging a ludic domain, and that forms of play also manifest in games.

Continuing on the topic of interactivity as a new media form Eric Zimmerman offers constructive insight into "how games can be narrative systems in ways that other media cannot". Similar to how Boorstin enables multiple viewing approaches in film, Zimmerman asks what are playful aspects when engaging a static text? His debate of the four modes of narrative interactivity is presented:

1. **Cognitive** Interactivity; or Interpretive Participation with a Text
   psychological, emotional, hermeneutic, semiotic, reader-response
2. **Functiona**l Interactivity; or Utilitarian Participation with a Text
   functional, structural interactions with the material textual apparatus as part of the total experience of reading interaction.
3. **Explicit** Interactivity; or Participation with Designed Choices and Procedures in a Text
   "interaction" in the obvious sense of the word: overt participation
4. **Cultural** Interactivity; or Meta-interactivity with a Text
   interaction outside the experience of a single text such that readers appropriate, deconstruct, and reconstruct linear media, participating in and propagating massive communal narrative worlds.
   (Zimmerman 2004)

These four modes are not distinct categories, but rather overlapping layers of participation that occur to varying degrees in all media experience. Most interactive activities incorporate some or all of them simultaneously.

Another way to link this understanding of play to narrative and interactivity is to consider the playful aspects of an explicitly interactive narrative. The challenge for the creator of an interactive narrative is to design the potential for play into the structure of the experience, whether that experience is a physical object, a computer program, an inhabited space, or a set of behaviors (Zimmerman 2004). This idea becomes especially relevant in section 3 as integrated architectures and visual presentation combine into novel experiences in interactive narrative.

Lastly, Zimmerman's in fact addresses the user model and how forms of interactive narrative are to be experienced. One approach is a *Content-Based or Embedded* structure consisting of pre-generated "content" that is navigated by the participant as she interacts with the system. The branching Choose-Your-Own-Adventure structure is a clear example of this type as the content is already embedded in the system before any interaction begins. The alternative approach is a *System-based or Emergent* structure that uses rules and procedures resulting in unexpected experiences and content. Instead, stories emerge as the participants follow the rules of the game. Examples here are less defined for interactive narrative as there are many approaches. Ultimately this is also an

authoring dilemma made more apparent as systems are introduced. This will also be discussed in relation to specific author's contributions.

1.3 Foundations in interactive Fiction: Text Based Interactive Examples

Creative writing on its own can be composed in such a way to enhance interactivity. Text based interactive fiction is done this way through pre-authored branching story paths and a text parser. There is great variety in the types of interactive fiction such as novelty in interface, plot structure and narrative, player character & narrative voice, characters and conversation, unusual setting or world model, and puzzles. The user can usually type in standardized commands to either change position in space, or interact with objects, etc. This particular genre of storytelling technique enabled an especially sophisticated game experience that continues today, Zork being one of the first created in 1979. The premise for Zork: Set in an underground dungeon filled with many novel creatures and objects, you are an adventurer whose goal is to find the treasures hidden in caves and return alive with them. There are a number of text adventures similar such as Photopia, Galatea, Savoir Faire and The Case of Randolph Carter. Many of these authors have developed successful careers in this genre such as Emily Short.

One a side note regarding the authoring context for IF (since this is a reoccurring theme), there is fairly developed software for commercial use in writing your own interactive fiction (Z- Code: Inform). Upon inspection of these tools, there were detailed feature types that could be easily specified by the author such as, world modeling, relations, actions, rules, and chronology. This is interesting because obviously the writers themselves are empowered to write their own stories in this fashion. I am curious when the same could be true for writers of immersive stories.

2. Seminal works in Computer Sciences and Artificial Intelligence

Seminal works in computer sciences addresses the generation of text-stories fundamentally differently than the previous authors, primarily focusing on planning and reasoning approaches for solving problems. It should first be said that humans have a lifetime bias when creating and comprehending a story and to emulate this artificially in a basic sense, requires computational models of cognition in addition to simple story grammars. In essence, we need to take a giant step back from our assumptions on story and come up with a basic model of expressing them computationally. The following approaches address two areas of pursuit: character planning and story generation techniques. These illumining contributors reveal the true complexity of the task at hand and that researchers still face many of the same challenges today. These following authors also address aspects of cogitative processing that are normally undefined or not well defined by the authors in section 1.

2.1 Character, Plans, Actions, and Goals

In Schank & Riesbeck's Inside Computer Understanding, character, plans, actions, and goals hook together. In an effort to create an effective model of understanding, the authors oriented artificial intelligence in relationship to cognitive simulation. This is useful for understanding what kind of knowledge people have, how it is stored, accessed, applied, and acquired.

Schank and Riesbeck brought forth the notion of *conceptual dependency*. First there had to be a general theory of language processing dependant on communicating meaning. After which, the representation of meaning and events could be drawn from the story world content via physical events, mental events, intentions, physical causes, mental causes (i.e., reasons), known clusters of related events/intentions, and prediction of consequences or repercussions of events. The preconditions developed were:

EVERY Event has:

- An actor
- An action performed by the actor
- An object that the action is performed upon
- A direction in which that action is oriented

Another aspect of conceptual dependency is a *theory of context* that can decipher casual relationships between events and states. Thus the notion of routines, goals and plans that take shape as actions performed can affect subsequent attributes of the story world. In addition plans can have long or short term goals and imply story predictions such as satisfaction, enjoyment, achievement, and preservation. (Riesbeck 1981)

Schank and Riesbeck's logic based problem solving behaviors were central components in Meehan's thesis, The Metanovel: Writing Stories by Computer. His program called Tale-spin was created to write Aesop fable-like stories as a trace through goal-directed procedures. Aside from the challenges of text generation, the resulting stories revealed insight into how people behave and how they are communicated.

The main criticism for the system was that plot style was minimally addressed: the stories were coherent and causally connected, but not so interesting for the reader. In other words there was no moral of the story from an authorial sense. What would Aristotle say - remember the primacy of plot! Story worlds are theoretically infinite spaces of which only a small selection is used when creating a story. Talespin's, final text output were stories about animal characters that had no larger point and some would say boring. Egris might also comment that there is no climax to the story because there were no higher level goals (conflict) for the characters portrayed – and thus the stories created tended to be uninteresting. To say another way, the results would not make it far in the screenwriting business by a long shot, but it did introduce an aggregate level of information necessary for storytelling.

As we've seen previously, character portrayal is often the main vessel during the telling of a story. Character consciousness includes capturing exterior actions and behaviors in addition to *internal* thoughts, intentions, and

emotions. For Mueller, the act of daydreaming is a pervasive act of human experience that in effect is an associative model of consciousness. He asks “can a computer or (agents controlled by computer) be intelligent without being able to daydream”? Mueller developed his theory of human daydreaming implemented in a program called Daydreamer. His goal was to investigate dreaming from the standpoint of computer modeling and hypothesized “it *should be possible to learn from imagined experiences in addition to real ones”.* The implications for narrative are obvious, to open a window into the mind’s eye of your actors.

Literature on daydreaming opens a Pandora’s Box of theories and authors in the field of psychology. This is important in interactive narrative as these models shed personality and insight for characters. The authors and psychological theories Mueller researched included Hobbes’ unguided and regulated thinking, association theory, William James, “stream of thought”, Freud’s hidden and repressed desires, Bleuler’s autistic thinking, Varendonck emotionally emphasized recollection, Green’s childhood development, Singer- Imaginal Process Inventory survey, and Klinger’s theory of Fantasy (Mueller 1987).

The Daydreamer program takes the viewpoint of a young female has two goals; to be in a relationship and to be entertained. Using episodic memory, Daydreamer serves many important purposes such as learning from imagined experiences, creative problem solving, and useful interactions with emotions. Many of these areas are addressed further in section 3.

The implications for learning and decision making as an ongoing mental process, especially in the realm of storytelling, is as follows: it enables the formation of intentions to perform certain aspects in the future, it allows for the exploration of alternative plans for achieving a goal and then forming an intention to carry out the best such plan, and lastly when one is otherwise unoccupied with a task – the program enables discovery of negative consequences of carrying out a future intention that might not otherwise have been recognized (Mueller 1987).

> “The essential and primary function of imagination is to carry out the process of trial and error on the imaginary plane, to depict each situation and the consequences of each step of action, before the action is accomplished or even begun. (Mueller 1987)

Daydreamer also incorporated an emotional model as a mechanism for selecting among multiple goals. This model would determine the focus of attention in processing and in turn could be influenced by other emotions. A single event could thus spark a sequence of daydreams and corresponding emotions, perhaps at last resting on a final emotion. Lastly there was a consideration for emotions on events in the external world vs. emotions contained in internal events or daydreams. Emotional models are discussed further in section 3. Integrating these models joined with visual presentation and action-behavior models combine to form more compelling narrative experiences.

Muller’s work boldly attempts to address the complexities in human emotional thought. From the insight gained in psychology and related fields, there were still many phenomenal aspects of daydreaming that could not be modeled in his system such as: interior monologue or verbalization with other actors. Mueller was still able to show depth of character and complexity in thought even though the narrative itself was severely constrained.

Daydreamer shows the immensity of a narrative from the standpoint of a single actor, multiple agent systems are discussed further in section 3.

2.2 Story Generation

The previous character centric systems evolved from basic plans and actions into inner emotional states. The shortcoming with these systems (already seen in section 1) is actors need to have a direction and a more a global cooperative understanding with other actors to successfully enact a story. The following authors have addressed this aspect in particular.

The relevant discussion point here is distilling story patterns into grammars -- a set of well defined rules used to create stories. As we have seen previously in theater and filmmaking, a storyteller must fashion a story to convey an interesting message so why shouldn't a computer take the same approach? Lastly, the grammar, like the storyteller must understand the story at every level: surface format, message level, actions of the characters, events of the story, & literary values

One of the central research endeavors of Turners Minstrel program is an authorial aggregation of meaning to form interesting stories. In many respects, his work is a logical extension to the character driven approaches undertaken in Tale-spin and Daydreamer. Minstrel's storytelling approach can suit a particular authorial theme, consistency, drama, and presentation requirements. Minstrel's story level planning goals make sure that character goals would rise properly, become achieved, and that actions in the world effect characters appropriately. Minstrel is concerned with individual character goals and sequences only to the extent that it supports the larger story objectives. (Turner 1994)

It is worth mentioning that Minstrels story level planning goals are in alignment with many of the authors discussed in section1. Its thematic goals ensure a moral or general truth of a story and that this message is interesting. Its consistency goals seek to keep the story plausible and real and that characters are plausible and rational (although rationality is not a requirement for a good story). Dramatic goals focus on a writing style that focuses on suspense, tragedy, characterization, and foreshadowing. And lastly its presentation goals try to deliver a well read piece. (Turner 1994)

Again a seemingly difficult authoring problem is simplified into a combination of case based reasoning joined with Turners main heuristic called Transform-Recall-Adapt Methods (TRAMs). The basic premise is that one can transform the current problem into a slightly different one, then recall and adapt similar problems from memory, using case based reasoning, back onto the original problem to create a new solution. In Minstrel, the author uses TRAMs to seek novel stories outcomes in accordance with story level planning goals mentioned above.

In the end, Minstrel created short fables about King Arthur, his noble knights, the princess, and dragons. Upon evaluation of the system, Minstrel's stories are comparable to those of a younger high-school student. This is again due to limitations in natural language generation (NLG) which will be discussed further in section 3. Although

Minstrel is a remarkable achievement in computer authorship, the types of stories created are still far from the caliber necessary for broad audiences.

In addition to Turner, there are a number of authors who have addresses other aspects of encoding story grammar. In Lang's Declarative Model for Simple Narratives, story grammars are informed by a first-order theory of rational intention in autonomous agents which allows goal-directed behavior. Unlike natural languages such as English, first order theory uses unambiguous formal language interpreted by mathematical structures. To accomplish this, Lang's model uses a temporal logic of episode and setting to represent states and events. Their results however, a program call Joseph, did not seem to yield any better text output results in terms of story presentation from a reader perspective emphasizing the NLG problem once more. (Lang 2003)

Paul Bailey attempted to approach automatic story generation based on a model of cognitive states and processes within the mind of an imagined target reader of a story. His rationale was to examine a fictitious reader and their reaction to story artifacts (such as expectations, questions in response to events, and relative strength of inquiry) through a step-by-step heuristic search. Through this process, the knowledge structure of the story emerges. (Bailey 1997)

Although seductive in intention, Bailey's research approach did not continue for a variety of potential reasons. For one, his reductionist approach of an imagined reader's perceptual state did not seem to resonate, possibly because of its restricted view (though it does seem quite similar to Propp's view on understanding folktales through functions). As we have already seen in Boorstin and Zimmermans works in section 1, there are already variety of responses a reader could have for a given story anyways. Lastly, his approach seems very close to a hypothetical "Storydreamer" program without any descriptive notion of the artifacts being told in the story. This leads back to the translational aspect of abstraction problem mentioned earlier. Lastly, Bailey's approach may have been ahead of its time because a clear inquisitive user model of interactive narrative has yet to be defined – because prototypes are still few and far between.

And then came Brutus "…a storytelling agent specializing in narrative that involves betrayal first and foremost, and also self-deception and other literary themes" (Ferrucci 1999). For the creators of Brutus, the explicit goal for the authors was to pass a Turing Test of literary creativity…that a judge would not be able to tell the difference of a short story text written by a human or by Brutus. Like Lang's work, a generalizable first-order theory was applied in the creation of what became a single convincing story of betrayal with a few stylistic iterations. There was also an exhaustive and evaluative proof-reading of the story structure, story outline, and language generation – performed by the system to polish the final output for better readability. A great achievement on its own, the result did read very well. The problem was the system was not very flexible in an authoring sense; it was explicitly designed to tell a single well crafted Turing Test passable story on betrayal with a few different iterations. The challenge is touched upon again in section 3 with alternative models for interactive narrative and the allowance of plot variability.

Lastly, Storytron "…a radically new paradigm that redefines everything" as creator Chris Crawford states. In Storytron, which at the time of this writing has its own Storyworld authoring tool publicly released, the player is a

character within a multi-agent "dramatic context". Each character is pre-authored with "emotional dynamics" set by the storybuilder according to his or her artistic vision. Storytron disregards the complexities of natural language generation also seen in previous works for a more symbolic mode of interaction. Instead, authoring stories occurs via a visual/symbolic scripting language that the players must first become familiar with. The language is the only formal means of interaction with the system although simple 2D emotive pictures are also being used during runtime.

Crawford's dramatic principles are expressed in Strorytron through a "Verbweb" where verb-based dramatic interaction can only happen when it is dramatically appropriate. Verbs are performed by the actor and computer controlled actors, which allow for extremely rich and varied behavior while ensuring that each action is dramatically significant to the extent the author has allowed. Furthermore roles, options, inclinations, plans, events, actors, and stages are all elements within storybuilding open for authoring. The one aspect that does not seem to be addressed well is a sense of a global drama system over that of any individual character– to be discussed in the next section (Crawford).

It is not possible to measure the success of Storytron since this system is still in development. The clear difference seen already is that this is one of the first systems offered for a relatively artistically minded community of Storybuilders (perhaps as Z-Code was for interactive fiction writers). Second Storytron supports a limitless user created story world which seemed to be a limiting factor for range of expressivity in previous academic works. Visually speaking, Storytron falls short of a visual authoring environment envisioned by Loyall's research in the Oz project. Time will tell if this becomes a catalyst for a large group of authors engaged with interactive storytelling as a medium.

3. Integrated Architectures and Interaction Models

Informed by the previous theoretical and computational works in section 1 and 2 as to what constitutes a story, the final set of authors focus on more recent developments in interactive narrative systems that also introduces a *user interaction model*. It is clear audiences experience a story on many levels simultaneously (as seen in great works in theater and film) besides just text, thus interactive narrative is inherently multimodal including visual representation. As examples of interactive narrative are shown to audiences outside a laboratory, user modeling and methods for evaluation requires more attention and reflection on the process itself. Understanding audience expectations, playful aspects of engagement, and embedded/emergent approaches will help fine-tune future works. Recent computational models for interactive narrative have followed this notion in an effort to bring to life their stories. Key aspects of these systems are interrelations between character and drama management systems, character emotion and behavior, visual presentation, and alternative theories and applications for interactive narrative systems.

3.1 The Oz Project

Bates, Reilly, and Loyall's Oz project is, without a doubt, the goliath of an integrated system for interactive fiction. The project itself requires a certain level of explanation to address its components because so much is unique in approach. However some will also sound familiar as it is an amalgamation of successful aspects of works presented in section 1. Furthermore Oz's authors' contributions have been enhanced upon and debated by many others researcher which will be discussed later in this paper.

The Oz project at Carnegie Mellon University spanning approximately 10 years (1992-2002), includes multiple components working in concert: a simulated physical environment, a set composed of automated agents, user interface, and planner. The goals for the Oz project is to suspend disbelief, goal directed reactive behavior, agent emotional state and behavior, social knowledge and behavior, and natural language generation. The broad and shallow agent architecture called TOK is comprised of these components: HAP – Reactivity and goal directed behavior, EM – Emotion and social relationships and Gump/Glinda focusing on language analysis and generation. Furthermore, Oz's model of perception includes *Sensory Routines* and an *Integrated Sense Model* that monitors relationships such as sight, sound, time demarcation, and locations between encountered objects. (Joseph Bates 1992)

The foundation for a model of emotion has been partially addressed thus far. We saw in Mueller's work how emotion-as daydream thoughts can affect goals and vice versa, and for Egris, we some gained some insight in terms of character psyche, however there has been little attention to a general model for emotion *and* behavior in believable characters. Fortunately an excellent model already existed: Disney's - *The Illusion of Life,* where artistry through animation reveals humanity. The central tenets are as follows:

- If the character does not react emotionally then why should we as the audience?
- The emotional state of the character must be clearly defined so proper emotional status is defined - Thought process reveals feelings
- Accentuate the emotion and use time wisely to let the audience savor it. Conveying emotion, exaggerating it, toning it down, foreshadowing, etc
  (Bates 1994)

Specifically regarding emotion and social relationships, EM develops emotions from a cogitative base: external events are compared with goals, actions are compared with standards, and objects are compared with attitudes. As HAP executes, EM is informed and creates these emotional states. Depending on the goal success or failure leads to a variety of emotional states such as happy/sad, hope/fear, pride/shame and reproach. Anger, gratitude, gratification, remorse, arises from combinations of other emotions. Love/hate depends on attitudes- which are used to model social relationships (human/agent). Emotions and attitudes can also decay over time as well as have accent such as depressed is a feature of sad. (Joseph Bates 1992)

HAP is the name for TOK's goal directed reactive engine. Upon closer inspection, HAP controls internal states, plans, goal fitness, behaviors, and integrates with EM all during execution. Agent perceptions, current goals,

emotional state, and other aspects of internal state are continuously chosen. In addition, goals themselves are prioritized to determine emotional importance in EM. The resulting plans (or sets of actions with goals) are initiated from an unchanging plan memory. HAP's Active Plan Tree (APT) specifies the location where all active goals and plans are stored over the "perceived" state of the world through context conditions and success tests. During execution, HAP modifies the APT – and – evaluates the context conditions and success tests for goals continuously. As these are true/false, based on priority, new goals are prescribed. Related goals are organized and clustered into what is referred to as behaviors. Finally, behaviors are activated by goals and can be created in pursuit of another goal. (Joseph Bates 1992)

The initial results the Oz program developed is very similar to earlier text based interactive fiction examples, except the main character, a pet cat name Lyotard, is a dynamic actor in the story. Lyotard has simple likes and dislikes which may turn from a relaxed state to one of mild hate depending on the player interaction. Hate prompts the cat to exhibit either aggressive or fearful behavior. HAP is aware of EM's processes and can change the resulting behavior such as deciding to change proximity – and move away from the threat.

This work stands out because it is one of the early broad story generative examples that include a user interaction model along with the story characters. Furthermore, integrating a semi-autonomous emotional model with the larger architecture provide more realistic feedback to the user in terms of expectation, anticipation, and intention.

3.2 Emotion, Believability, Psychology

Bates work was extended by Reilly thesis in believable social & emotional agents, the primary differences being Reilly's work involved multiple human characters engaged in non trivial social interactions titled. The 3 prototypes created were "Robbery World": the player takes the part of a police officer who gets a call about a convenience store holdup that he/she must try to stop, "The Playground": the player is a child on a schoolyard playground and wants to trade a few baseball cards and must therefore negotiate, and "Office Politics": the player takes the part of a project manager who is confronted with crunch time decision making involving co-workers. Oz's integrated architecture was already well suited to address combinations in emotion and social behavior and thus increase believability.

The EM architecture was also enhanced to support this research goal with new emotion types, techniques for emotion expression, social influences, and emotion linkages to action. Emotion types include: cognitive-appraisal *emotions* (from events, actions, and objects in the environment), reflex emotions (from sense data), episodic memory-based emotions, sympathetic emotions, social contagion, and body-feedback emotions. Furthermore mapping emotion structures onto behavioral features required new methods of expression such as individualized personalities, emotion repression, feigned emotions, redirected behaviors, atypical behaviors, and mixing emotions. Social considerations for multi human systems allows for a variety of social inferences such as attitudes

about other agents, Interpersonal relationships, social norms, social roles, social goals and behaviors. Lastly, influences that emotions have on *actions* include decay rate, the relationship between emotions and goals, emotions and plans, and emotions and actions. (Reilly 1996)

In parallel with EM, a model of believable agents is used to coordinate activities, evaluate its success or failure, and monitor joint behavior. ABL – A Behavior Language was created to coordinate multiple intelligent activities such as gaze, speaking, walking, use objects, gesture with hands, and conveyance of facial expressions, all at the same time. Once a behavior completes all of its steps, it succeeds and goes away. However if any of its steps fail, then the behavior itself fails and the goal is forced to choose a different behavior to accomplish its task. An important feature of ABL is support for *synchronized* joint behaviors, which helps the author harness the power of multi-threaded programming (Reilly 1996).

It is no surprise that a *visual representation* of an interactive story world became the next extension to the Oz architecture. Since Oz already had a basic world model built into TOK, the architecture was capable for expansion in a similar way Reilly's work enhanced EM and ABL. Loyall's thesis Believable Agents: Building Interactive Personalities claimed that believable agents could be powerfully used for art, entertainment, as part of interactive story systems, social user interfaces, or teaching systems. His intention was to create an authoring environment composed of goals, behaviors, the enactment of goals & behaviors, and the resulting actions:

"I want to give the creators of believable agent's direct control over the details and richness of their creations, just as traditional animators have control over the details of the characters they bring to life. It is also possible that allowing artists to directly craft the behavior of their agents is one of the best paths to high quality, artistically rich believable agents."(Loyall 1997)

This nicely ties back into one of the original inspirations for Oz: Disney's - *The Illusion of Life* which after all, cartoons are inherently visual. Going visual for Loyall undoubtedly raised many questions such as choosing an appropriate abstraction level, audience expectations for believable behavior and, once again, the extents character intelligence even matters to tell a good story. When in doubt, this becomes an artistic problem, is the simple response. This position also resonates in Reilly's and Bates work. These authors envisioned a new set of tools and methodologies that are suitable for the *artistic* nature of these problems "The goal of building believable agents is inherently an artistic one…Creating believability is NOT the same as creating intelligence" (Reilly 1996). In conclusion, AI systems designed for agent architectures that enforce rationality and intelligence would be inappropriate for building believable agents.

Loyall's research was not without its challenges. HAP's architecture required additional coordination for multiple agent pursuit of goals, looking ahead, responsiveness, and composite sensing. Using a system of priorities, HAP manages multiple goals by concentrating on the most critical. When looking ahead, HAP attempts to provide the next action for each thread before the current action finishes. On response, agents must be able to think at a speed that is appropriate for what people expect of them in order to be believable. Agents must also use composite sensing to locate and orient agents in relationship to the simple terrain. (Loyall 1997)

Loyall's visual prototype entitled The Woggles, Edge of Intention, main criteria and evaluation metric for believable characters was that agents excel the following 7 areas – personality, emotion, self motivation, change, social relationships, consistency of expression, and illusion of life (appearance goals). For the system evaluated, character change, consistency of expression, and exist in a social context were fixed parameters. Aside from this, the user testing found the system to be overall very positive. Each woggle had a distinct characteristic that was graphically represented in 2.5D (pseudo 3D) through simple cartoon shapes. The future directions for this research are many such as building a more complete natural language generation approach, richer physical bodies, creating learning approaches, and to continually attempt to build better believable agents. Many of these improvements manifest in later work such as Mateas and Stearns work Façade and Aylett's FearNOT! project.

The problem of inherently fixed emotional states and learning approaches is addressed in El-Nasr's adaptive model of emotions using Fuzzy Logic. Also referred as "Emotional Intelligence" by psychologist Daniel Goleman, memory, experience, and judgment all have a major influence on emotional processes for characters, and this in effect is crucial for users' assessments of character believably. Through an analysis of psychological models and a review of previous work in motivational states, El-Nasr proposes FLAME (Fuzzy Logic Adaptive Model of Emotions). FLAME is an event-appraisal based model that represents emotions by intensity, and then maps events and expectations to emotional states and behaviors. Second, FLAME incorporates inductive learning algorithms for machine learning to better understand the agent environment such as through association among objects and expectations about the user. A prototype was developed using FLAME that modeled a cartoon pet's behavior where it was evaluated with user feedback. Through the incorporation of dynamic components, the results show a significant improvement in the level of agent believability. (Magy Seif El-Nasr 2000)

Because a user model for interactive narrative is still relatively undefined, Cavazza has offered additional insight into a player interaction model for multi-agent interactive narratives. Using his plan-based hierarchical task network (HTN) controlling characters' potential behavior(Cavazza 2002), he created a familiar situation comedy as a prototype to explore this model further to affect stories. For this example, he addressed how a player's direct physical interaction with virtual object could change or mislead an unfolding story or, using speech understanding to achieve the same effect (Cavazza 2002). In the prototype, the player acts as an invisible actor, or in "god" view, and can change the story world to foil plans or coach players into achieving their goals. Although the HTN system is using propositional logic in implementation, this work speaks more as a novel exercise in authoring interactive narrative experiences. However, as far as a storytelling metaphor is concerned, it seems like a very fragile system in terms of maintaining player agency and plot variation for meaningful stories.

Similarly, there are many psychological models which can be incorporated into a more author-centric interactive narrative approach. For Pizzi and Cavazza, this psychological model can play a dominant role over the course of a story (Pizzi 2007). Using the story of Madame Bovary, a novel by Gustave Flaubert, complex *Literary Feelings* emerge that control the story such as "feeling-of-emptiness, boredom, pride-of-having-a-lover, poetic-feelings, emboldened-by-love, jealousy-curiosity, feels-hatred-for-Charles, irritated-by-vice, and bitterlove-

feelings". Once again, Cavazza's methods need to be explicitly encoded into the system. For more generalizable and procedural approaches to plot and management and character systems, continue on.

3.3 Plot & Drama Management Systems

One ongoing challenge is how to procedurally create artist-shaped story worlds where the user also has the feeling of freedom? The problem already has already been addressed in this paper pertaining to clashes in film & interactivity where the artistic vision can quickly break or becomes diminished. Wehyrauch thesis addresses this challenge in terms of a generalizable method of encoding story aesthetics. His work is also associated with the Oz project and focuses on dynamically updating the story arc in relation to user preferences indicated through interaction. The goal is to preserve player agency and immersion characteristics within the story using artist determined "plot points". Plot points are defined as "important moments" in a story, in addition to a sequence of unique features dependant on permutations of the story. An evaluation function is then used to express the current model best suited to specific features. In this way, a story structure is imposed on the viewer's experience, while still allowing interaction. The authoring approach looks like this:

1. Write some linear (non-interactive) story as a sequence of "important moments"
2. Reverse-engineer your own thinking to figure out why you think that particular sequence is a "good" story
3. Capture this aesthetic as a set of features (over sequences) in an evaluation function
4. Make sure that you have (approximately) captured your aesthetic by comparing the output of the evaluation function with your own evaluation of a set of sequences (of course include the original story - the one your "really" want to tell)
   (Mateas)

More details about the drama management system itself reveal many similarities with a game of chess and how current moves can be projected into future game states. The drama manager watches the state of the world (including the user interaction) until a plot point is encountered. While the player interacts with characters eventually, some sequence of activities in the world will be recognized as causing a plot transition. The drama manager then collects the past history of plot point's in addition future histories of all possible sequences of remaining plot points. The past history plus each possible history forms a set of total histories where the evaluation function can now search. The system then makes a system move that maximizes the probability of generating a highly ranked total history. This allows the appropriate story structure to be presented to the user while preserving the player sense of agency. (Mateas)

Many of the Wehyrauch's concepts were incorporated into the drama management system of Mateas and Stern's acclaimed "Façade" program. Requiring years of collaboration to code followed by years of fine tuning the interwoven artistic content, it is perhaps the most realized and complete example of an interactive narrative to date. In overview of the project, Façade is a visually immersive 3D simulation (non-photorealistic abstraction presentation techniques were used) characteristic of many contemporary games except it also incorporates a

drama manager to enhance the player experience. It is composed as a 1 act play comprised of a rocky marriage that encompasses 2 NPC characters. The player controls a third character using natural language dialog interface.

Mateas and Stern expanded upon Wehyrauch's notion of plot points into even smaller story units called beats and their dynamic arrangements, referred to as beat sequencing. The term beat refers to the smallest unit of action that has its own complete shape with a central conflict and a minimal crisis. Beats are annotated by the author with trigger goals/subgoals, preconditions, and postconditions and effects on the story state. This instructs the drama manager when they make sense to use in the interest of creating an overall dramatic narrative – a *plot*! Façade's collection of beats and sequencing rules thus affect a dynamic and flexible version of a structured narrative graph and allow for continuous, uninterrupted immersion in the narrative.

Regarding Façade's integrated model of authoring, which was one of the projects primary architectural contributions, there has been some closely related academic research utilizing dramatic beats joined with character and story architectures. However the code and process itself has not released publically probably because the authoring tools themselves are non-existent or too crude at this point and requires much significant authorial labor. In the future there may be a way for the system to address this by being more generative. Scalability and fragility are also concerns as the current set up may not work within different settings or multiple interwoven plots.

Future thoughts for this project: because Façade is arguably the most prominent example of interactive narrative to date, its shortcomings exemplify ongoing research trajectories. Another major concern is in natural language *misunderstanding* such as non-understood utterances or spelling mistakes, false positives, and an asymmetrical range of expression. This problem is also ongoing in the AI communities. Furthermore the parsing techniques in natural language may re-map a player value incorrectly. Another more general problem is although agents speak in natural language, the player participation is limited to a phrase-constrained model. Imagine how *you* would feel in a real life dramatic situation where all you could do is type in responses (being mindful of spelling and grammar…)? This is hinting at a formalized model of interactive narrative which has yet to be defined. Although systems for voice dialogue have been discussed already in this paper, these systems are more restraining due to inherent variation in verbalization.

Recent news is that Stern is working on his next project called "The Party". It is unclear the extents of a system overhaul but it does involve more characters and to some extent, a blend of more dramatic plots. Perhaps the coming system will extend more of a protagonist role to the player and less on Trip and Grace controlling you "Let's keep the topic on Trip"... I will say that Façade is already a much deeper experience than current next generation console games that attempt interactivity such as Indigo Prophesy (note, Mass Effect has not been played at the time of this writing, but I am confident it falls short in this regard as well).

3.4 Visual Presentation and Performance Arts Theories

> "Creating a good interactive narrative requires an artistic as well as a computational contribution" (El-Nasr 2007)

Visual design in interactive narrative has become increasingly important as systems become more developed. Not only does the underlining architecture need to reconfigure dynamically based on user feedback, but so too should presentation queues also be appropriately adjusted. El-Nasr draws from well established theories such as Boorstin's perspectives mentioned previously and others in theater, performance arts, film, and animation. Her position is to tie in visual and performance arts theories into well developed existing systems to enable higher player agency. Her research presents a narrative architecture that addresses these aspects dynamically. The ultimate goal is to enhance engagement and the dramatic quality of interactive experiences to stimulate self-growth, self-reflection, empathy, and anticipation (El-Nasr 2007). The prototype for this research is called Mirage where in addition to the underlining story engine based upon the model of Mateas and Stern, a *director system* is introduced to coordinate interaction between the specialized subsystems: lighting, camera, and character control/action. Through the oversight of these sub systems, mood, emotion, and viewer engagement is focused.

Specifically, the director agent constructs a unified visual plan through the interaction of the subsystems, conflicts are identified and resolved, plans are merged and synchronized, and visual continuity is checked. The lighting system role is to select the best possible angles, positions, and colors for each light to satisfy the author's goals. The camera system can establish a cut or movement shot and calculate its field of view angle, orientation, and target position in relationship to character positions. And finally, the character control system uses a reactive planning technique very similar to Loyall's. (El-Nasr 2004)

Performance arts theories such as improvisation also offer insight into believable characters and convincing stories in interactive narrative (El-Nasr 2007). One example is variation of action and time for a given event; opening a door in haste or with reluctance can tell very different stories as this is a reflection of different physical and psychological states. All too often in games today, "opening a door" is portrayed in only one way. There are many others such examples referenced in El-Nasr's work involving character arc, tactics and goals, and emotion through action. However one of the biggest limitations is the extent these performative arts theories can be encoded computationally and there is ongoing research in this field especially. The bottom line is that as commercial games increase in visual fidelity in action-behavior using completely scripted or even procedural experiences, audiences should expect the same or better production values for interactive narrative.

3.5 Alternative Approaches in System Architecture, Theoretical Frameworks, and Application

As we have seen already, there is no single method for implementing systems of interactive narrative and there are multiple alternative approaches in the field. Although these are less developed as a prototype to

evaluate, they offer unique models and insight on how the current models are deficient and how addressing these aspects can lead to a stronger model for interactive narrative.

Szilas proposes a new model for interactive narrative, one where the system architecture has a better model of plausible character intelligence. This is more than an artistic concern. He is above all interested in a methodology of cooperative-design for interactive drama. Szilas recognizes there are still inherent fundamental challenges to grasp because concepts in interactive narrative *must* be embedded into a technical framework (it's not just a conceptual problem).

In the existing integrated architectures discussed, Szilas argues character intelligence is often sacrificed over the larger goals of the drama manager and sites Façade as one such example. The result is often the character can only handle strategic goals, without being able to react to their environment as a reactive agent should.

> "In these systems, while the reasoning rules of agents are implicitly implemented inside the drama manager, it would be simpler to do this with a proper multi-agent architecture… Solutions consists in rethinking the relationship between the drama manager and interactive agents in terms of cooperation rather than subordination"(Szilas 2005)

For Szilas, the requirements for a new architecture should contain a metric for believability. He proposes a combined two schema approach between actor and drama manager. This notion is very similar to the relationship traditional theatrical stage actors (or perhaps grad students) would have in relationship to a director (or thesis advisor). Scheme 1 –Agent action (with motivation) is presented for direction and Scheme 2 – balance of credibility and narrative interest. Thus, the intelligence of the agent is not confined to character's rationality but it extends to the agent's ability to *justify* itself and actions. (Szilas 2005)

Szilas also incorporates his own notion of narrative theory into computational models which is a blend of many of the topics discussed previously. However, as we have seen in El-Nasr's research in performance theories, the ones that don't encode very well may still be nonetheless useful. Like the actor/director schema, he proposes narrative schemas into his model composed of 3 layers: discourse, story, and perception. The discourse layer aims at conveying a message to its reader/viewer/listener via a moral of a story (implies a *system of values* used by the author). The story layer is succession of events and character actions, following certain rules based on screenwriting and models of psychoanalysis. And last, the perception layer, how the narrative is perceived during reading/viewing/listening – including emotional responses (Szilas 2003). These are very broad aims so the challenge of course is almost a test of endurance (as seen from the track record of both Oz and Façade) even a simple prototype takes years of sustained effort for validation. We will watch where this goes next.

Ivo Swartjes has a similar optimism how plot management and character autonomy can be improved from current systems. "Instead of forcing the characters to follow a certain plot development and compromising in believability and consistency, I propose to merely influence the emergent narrative to stimulate a good plot" (Swartjes 2006). His proposal also seeks to preserve character believability in an emergent plot driven multi-agent system. To accomplish this Swartjes describes a *fabula* structure designed to capture causality between story elements such as emotions, goals, actions, events and perceptions. What is meant by this is that the goals and

plans of the characters are motivated from a personal perspective, not a story perspective. Characters are meant to reach personal happiness, not to cause interesting drama. In addition a story layer is proposed to define a relevant selection of the fabula layer to form a story that follows a certain plot. Therefore it is not difficult to imagine that in fabula, many plots can coincide. By preserving character autonomy and instilling an *improvisational* sense of action, four ways are proposed to influence the story: (1) generating events to mediate the plans of characters, (2) influencing their perceptions, (3) changing the setting, (4) suggesting goals or actions. (Swartjes 2006)

Swartjes has a more passive approach to emergent narrative with the goal that stories become less contrived. In a way this approach seems like a more robust version of Cavazza's work in terms of enabling the player to apply different storytelling metaphors. He has indicated a that case based reasoning approaches will be used to achieve evaluate and achieve these metaphors – which gets back to the original question - how generative this process is from an authoring point of view.

Aside from adaptations in architecture, almost all the effort thus far in interactive narrative has been in research to better understand or enhance the medium such as validating a certain cognitive or theoretical model. It is rare and also enlightening to see to see advances thus far being applied in domains outside the usual halls of computer sciences departments.

FearNOT! Fun with Empathic Agents Reaching Novel Outcomes in Teaching is a virtual drama for children in anti-bullying education. It is appraisal-driven agent architecture presented as a mechanism for generating an emergent narrative. For educators, it was the creation of an *empathic* relationship between child and character that was seen as a motivating factor for incorporating this particular use of the technology. The interactional structure of FearNot! was inspired by the forum theatre approach developed by Brazilian dramatist Augusto Boal. The structure of dramatic episodes is divided by periods in which the child can give advice to a character via natural language generation similar to the one used in Façade. From a learning perspective, to emphasize the empathic connection between victim and child, it is advantageous if the child feels the victim is taking the advice seriously. (R.S.Aylett 2005)

There are certain aspects of FearNot! that could have benefited from the works discussed primarily in visual presentation. Due to the fact that the system was built on top of a totally scripted story, much of the content reuse was not well suited to this emergent approach and had a negative immersive effect. Some items had to be removed entirely like all dialogue, and animated camera presets. This project also highlights the need for a [procedural] believable character approach in animation and gesture which is an ongoing field of research. The logical next step for a system such as FearNot! would be to create the emergent narrative using one of the current approaches – however the cost of implementation, and ease of authorship for outside users will be more of a concern. On a side note, there are many educational spin off projects incorporating the uses of this technology in an augmented/tangible domain such as performances as this is perhaps better suited to a child's mode of learning through play.

Conclusions

Interactive Narrative is still in its infancy in terms of broad audience acceptance. By providing a literary overview of narrative in conjunction with seminal works in this filed, new systems proposed and developed today can be evaluated more accurately. As more of these works come to fruition, user modeling and evaluation becomes emphasized even further indicating the need for a formalized methodology. Also, authoring will continue to be a problem as not every storyteller has a computer science background. These evaluative steps in the process seem to be lacking. Ironically, to answer these questions, we must again backtrack into previous models such as gesture (theory of movement), improvisation, cognition, and psychology to name a few. This of course can only serve to make interactive narratives more engaging – although it will take more time.

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